NLOS Cannon:
Meeting the Demands of Future Combat

By Major Vincent J. Tolbert, AC

When Secretary of Defense Donald Rumsfeld terminated the Crusader 155-mm self-propelled howitzer program in May 2002, he told the Army to accelerate development of the future combat system (FCS) cannon, properly known as the non-line-of-sight cannon (NLOS-C). He provided funds saved with the termination of Crusader to develop an FCS cannon to support the objective force (2002 US Army Field Artillery Center and Fort Sill (USAFACFS) Annual Command History (ACH) Pages 61 and 80).

Projected for fielding in 2014, the NLOS-C will give the brigade combat team (BCT) commander unprecedented responsiveness and lethality. It will be networked for rapid target execution and situational awareness, have extended-range targeting and be able to attack point and area targets precisely using a suite of munitions that include special purpose capabilities—for example, the Excalibur suite of precision-guided munitions.

NLOS-C will provide sustained fires for close support and destructive fires for tactical standoff engagements. It is being designed primarily to support the FCS combined arms battalions (CABs) and their subordinate units in concert with line-of-sight (LOS), beyond-line-of-sight (BLOS) and external and joint NLOS capabilities.

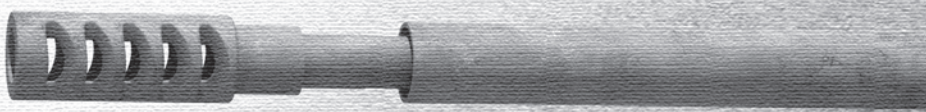
NLOS will be flexible—able to change its effects round-by-round and mission-by-mission, respond rapidly to calls-for-fire with its networking and high rate of fire, and provide a variety of effects on demand. The cannon will be able to move rapidly, stop quickly and deliver lethal first-round effects on target in record time.

Like Crusader, the NLOS-C will be capable of multiple round, simultaneous impact (MRSI). One cannon will be able to fire a series of rounds at different tube elevations quickly enough to have rounds impact simultaneously on a single target—a one-gun massing of fires. Coupled with the NLOS-C's superior rate of fire, MRSI will allow the cannon to provide record effects on target from fewer systems.

System Characteristics. The NLOS-C is one of eight FCS manned ground vehicles. Its operation will resemble the operations of all other FCS manned ground vehicles. Common features are the battle command system (BCS); planning, training and communications software; maintenance parts and procedures; water generation; resupply implementation; and others.

Chassis. Using a common chassis, the NLOS-C will have the advanced mobility of the FCS. The chassis will boast a suspension able to relatively smoothly traverse rough terrain at speeds of more than 50 kilometers per hour. For the first time in recent history, the cannon will enjoy the same mobility as the supported force.

The common chassis will feature reduced fuel consumption. Through a combination of engine and hybrid electrical advancements, the FCS will be able to travel hundreds of kilometers on its onboard fuel capacity.



Ammunition Handling System. The tasks of manually handling projectiles, powder charges and a rope lanyard to fire each round will be things of the past. In the NLOS-C, ammunition handling and firing will be automated. The process will include networking, all-electric drives, robotics and a laser igniter—all of which are more efficient, faster and less labor-intensive.

Tube Caliber. The NLOS-C will have a 155-mm, Zone 4, 38-caliber cannon. In May 2004, the Army and Field Artillery made a key decision on the caliber of the NLOS-C. Based on careful analysis, they opted for a 38-caliber 155-mm howitzer. The 155-mm howitzer tube was 58 percent more effective against personnel targets and 82 percent more effective against materiel targets than the 105-mm tube, also under consideration.

The Army and Field Artillery selected the 38-caliber tube over the longer 39-caliber tube. The 38-caliber tube trades the 39-caliber tube's additional four kilometers of range (using the M549 rocket-assisted projectile) but saves 1,367 pounds. With the weight savings, NLOS-C will be C-130-deployable with about 25 percent of its basic load of ammunition and still will satisfy the NLOS-C operational requirements.

Munitions. The NLOS-C will be able to fire the current suite of 155-mm ammunition and all developing 155-mm munitions. It truly will provide overmatching fires when it fires the future munitions.

Rate of Fire. NLOS-C will have a rate-of-fire of six rounds per minute sustainable for all missions in its typical combat environment. When moving, it will be able to respond to a fire order with the first round fired within 20 seconds of the vehicle's stopping. The howitzer will carry 24 complete rounds on board.

Resupply. One of the major concerns of any artillery piece is the amount of time it takes to resupply it. Throughout the world, artillery pieces are resupplied by hand in a time-consuming, manpower-intensive exercise.

An M109A6 Paladin crew loads its howitzer with a "man-in-the-loop" at the rate of one round per minute, making standard resupply last the bulk of an hour. The reload time can be longer in less than ideal conditions: at night, while wearing mission-oriented protective posture (MOPP) gear, in extremely cold weather gear or in wet/icy conditions.

The NLOS-C automated resupply will allow the cannon to rearm completely in

less than 12 minutes. When the NLOS-C transitioned into the FCS program it adopted the FCS resupply operational requirements. Within this operational construct, a resupply capability utilizing multi-role resupply "modules" is envisioned for the FCS brigade combat teams (FCS BCT) rather than a specific resupply vehicle for individual vehicles. In effect, the resupply function has been assumed by other assets within the FCS BCT.

Projectile Tracking System (PTS). PTS dramatically improves the accuracy of munitions fired from the cannon. Consisting of a narrow beam radar and detector, it tracks projectiles and compares "should hit" to "did hit" target locations before the round completes its trajectory. With this information, the cannon will be able to adjust the firing solution continually to achieve an optimum aim point in every fire mission.

This adjustment will occur round-to-round and dramatically improve the efficacy of the cannon's fires. Especially at longer ranges, PTS will result in a range and deflection probable error (PE) of 33 to 50 percent better (less) than Paladin.

When combined with improved sensors for targeting and modern munitions, PTS will ensure precision effects accuracy, even at the extreme edge of the cannon's range. PTS is a mature technology that does not add significantly to the weight of the cannon.

Crew Cockpit. Crusader spent much of its effort on optimizing the crew interfaces and operating areas. The result was a cockpit for the crew that facilitated the tactical employment of the howitzer in sustained operations. The cockpit abilities are largely independent of the type of ground combat vehicle it is located in, so this technology will be used across the FCS variants.

Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C^4ISR). The NLOS-C fires will be enabled by networked fires. (See the article "Networked Fires" by Colonel John L. Haithcock, Jr., in the January-February edition.)

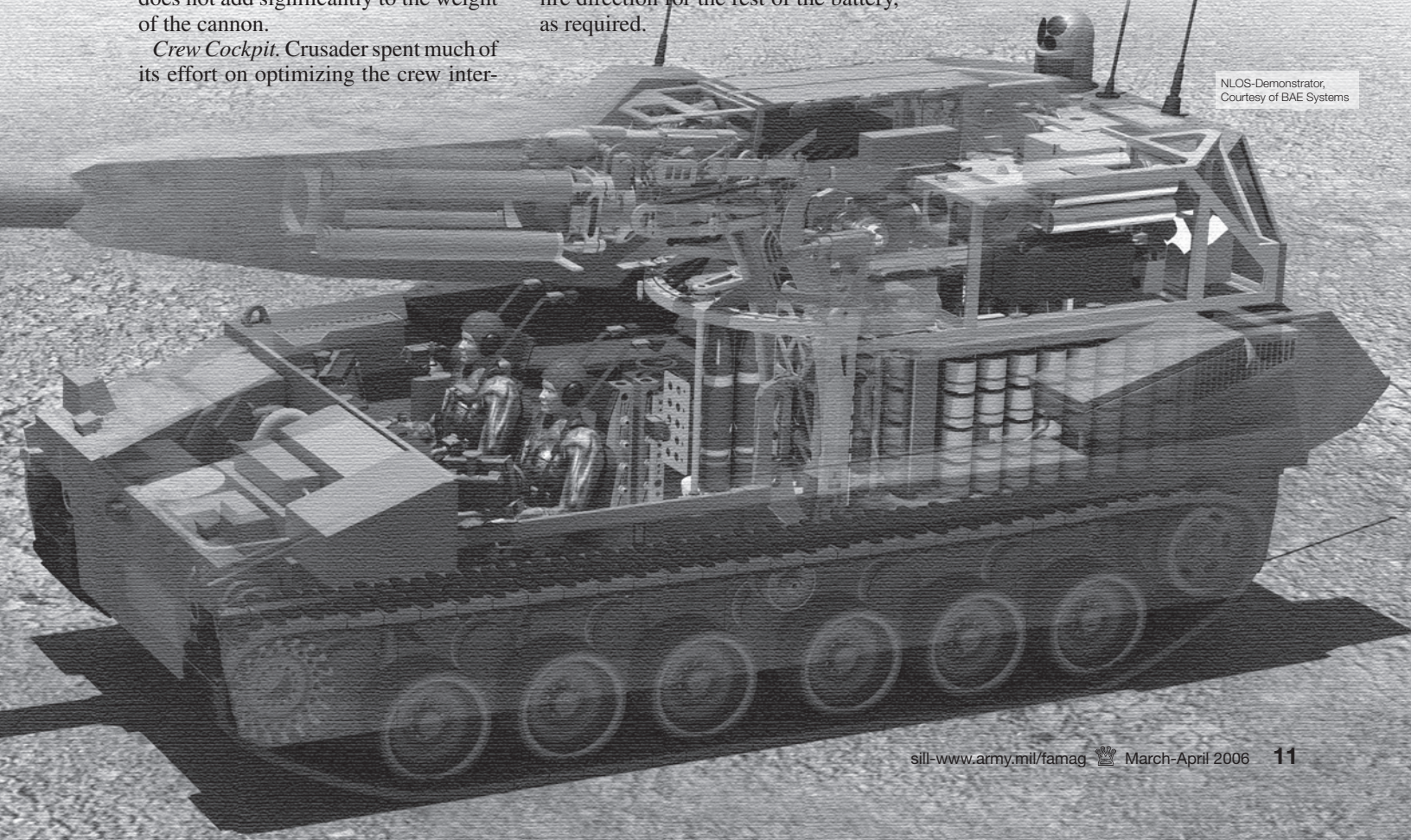
Integrated into NLOS-C's software, networked fires will exploit technological advances and combine them with new concepts in controlling fires. This will enable the force to link a target with a shooter in real-time, adjust fires allocations dynamically, and assess and reassess target status and damage while reducing the chances of fratricide or collateral damage. The results of networked fires will be the best pairing of effects and targets at the right time in support of the commander.

NLOS-C will receive and compute fire missions from all fielded and developmental target acquisition sources and command and control systems. Each NLOS-C will be able to compute its own firing data and provide limited tactical fire direction for the rest of the battery, as required.

Survivability. In terms of survivability, the NLOS-C's composite armor around the crew is substantially better than Paladin's. An active protection system (APS) will protect the crew from rocket-propelled grenades (RPGs), anti-armor missiles and tank-fired high energy anti-tank (HEAT) rounds. The FCS BCS will alert adjacent FCS platforms to an enemy threat, enabling cooperative responses to threats in their midst.

Also, the NLOS-C will have a crew-served weapon for close combat that will be able to engage stationary or moving targets up to 1,500 meters away. The primary candidate is the objective crew-served weapon, but others are being considered, such as a modified M2 .50-caliber machine gun.

The FCS program uses a holistic approach to minimize exposure to threat systems. For example, it first will use its common operational picture (COP) and employ tactics to try to avoid encountering an overmatching system. Should it encounter enemy forces, it will try to avoid detection and acquisition by managing its thermal, visible and acoustic signature. Should it be attacked, it will try to avoid a hit or penetration through its APS and composite armor. And should it be hit, it will try to avoid being killed through redundant systems and smart placement of critical systems.



NLOS-Demonstrator, Courtesy of BAE Systems

FCS vehicles will have a series of sensors for situational awareness and to navigate, detect and engage threats. The sensors will be both passive and active, cover infrared and visible light spectrums, and use a multifunctional radome to detect obscured or hidden vehicles and personnel. The NLOS-C crew will be able to use the sensors for cueing (alerting the crew to a potential target) and targeting (determining an enemy's location to within 25 meters).

In effect, when the future force BCT is deployed, any FCS platform will be able to locate a threat accurately enough to respond with a variety of precision options as long as the threat is within range of its sensor. Future enhancements will allow FCS vehicles automatically to recognize and categorize targets detected by their sensors and share the information with other FCS vehicles.

Other Technologies. The NLOS-C will benefit from several technologies matured under the Crusader program. This includes the laser ignition system for the propellant, embedded training, drive-by-wire technologies and a real-time common operating system for the manned ground vehicle system.

NLOS-C will use the titanium power generation and control systems that were optimized for Crusader. The NLOS-C also will use a 15-inch band track, a one-piece reinforced rubber track that will be used throughout the FCS family of vehicles. Potentially, it will make the vehicles lighter than comparative wheeled systems.

By taking advantage of technologies developed in the Crusader program, the NLOS-C developmental timeline is shorter.

Testing and Fielding for the NLOS-C. The NLOS-demonstrator, a prototype NLOS-C, is being tested at Yuma Proving Ground, Arizona. It features a modified XM777 155-mm towed howitzer tube mounted on a platform, a fully automated ammunition loading system and a magazine that can hold 24 100-pound projectiles. The platform uses an advanced band-track system and is propelled by a hybrid electric-diesel engine to provide improved mobility performance and reduce fuel consumption.

In August 2003, the NLOS-demonstrator fired its first round. Two months later in October 2003, the NLOS-demonstrator completed four, five-round missions at six rounds per minute and later finished several other missions at a slower rate of fire. By the end of October 2003, the NLOS-demonstrator had fired 140 rounds. To date the NLOS-demonstrator has fired more than 1,700 rounds.

Congress directed that the Army field NLOS-C in 2010 as part of the FCS overall fielding and to develop NLOS-C independent of the other FCS variants if they could not achieve the 2010 fielding. The Army is committed to developing and fielding the NLOS-C as part of an integrated FCS strategy while meeting Congressional intent by delivering eight prototypes starting in 2008. The NLOS-C prototypes will lead the development of the manned ground vehicle fleet with early testing and risk mitigation and ensure the NLOS-C development is synchronized with FCS manned ground vehicle development as well as support the fielding of the NLOS-C funded vehicles in 2010.

With the fielding of the NLOS-C, the FA will have a 155-mm FCS that is more survivable to support an FCS-based Army with faster, more lethal fires that impact with more precision and with multiple options for effects at greater ranges. It will be networked for targeting and situational awareness and have automated firing and resupply. In short, it will give the future BCT commander the all-weather, responsive fires option he needs to win in future conflicts.

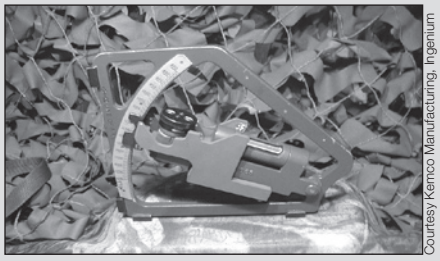
Major Vincent J. Tolbert, Acquisition Corps (AC), is the Non-Line-of-Sight Cannon (NLOS-C) Project Officer in the Training and Doctrine Command (TRADOC) Systems Manager Cannons (TSM Cannons) at Fort Sill, Oklahoma. He also was the Test Officer for the Limited Users Test for the Mobile Gun System (MGS) in TSM Tanks, Fort Knox, Kentucky. He served as the Assistant S3 and Commander of Service Battery in the 3rd Battalion, 29th Field Artillery, at Fort Carson, Colorado, part of the 4th Infantry Division. For Operation Iraqi Freedom, he deployed from January to July 2003 as part of the Fire Support Element (FSE) of the Deep Operations Coordination Cell (DOCC) in the Coalition Forces Land Component Command (CFLCC), Third Army, in Kuwait. In the DOCC, he was responsible for the execution of time-sensitive targets (TSTs).

New Gunner's Quadrant Lighting Kit

The new lighting kit for the M1A1 and M1A2 gunner's quadrants is designed for use in the 105-mm M102 and M119 howitzers, the 155-mm M198 and M777 howitzers and mortars. This kit easily attaches to the bottom of the gunner's quadrant allowing the Soldier to read the azimuth and elevation scales, micrometer and level vial in the dark.

The lighting kit illumination wavelength is between 550 to 650 nanometers to maintain light discipline for night operations. Until now, the Soldier read the instrument with the aid of a flashlight held by another Soldier, potentially compromising light discipline.

The unit is powered by two CR2450-sized three-volt lithium batteries available through either the Defense Logistics



Courtesy Kemco Manufacturing, Ingenium

Agency (DLA) supply system or local discount stores. The kit has an automatic shutoff after being activated for one minute, extending the battery's life. For example, if the lighting kit is inadvertently placed in the M82 gunner's quadrant carrying case while in the "on" position, it will shut off after one minute. Battery life is estimated at two years.

The gunner's quadrant lighting kit has been field-tested at Fort Campbell, Kentucky, by Headquarters Service Battery, 1st Battalion, 320th Field Artillery, 101st Airborne Division (Air Assault), and at Fort Sill, Oklahoma, by the USMC Field Artillery Chief. The kit performed very well.

The gunner's quadrant lighting kit is available for purchase through the DLA via NSN 1290-01-531-3062 or with a government credit card directly from the kit's manufacturer, Ingenium's Kemco Manufacturing Division, using the company's website: www.kemcomfg.com. Delivery takes eight to 10 weeks after receipt of the order.

MAJ Corey B. Chassé, FA
Chief, Current Cannons
TSM Cannon, Fort Sill, OK